

CLAIMS

What is claimed is:

1. A method of preventing a disc from being scratched by an objective lens, the method comprising:
 - performing a focus pull-in operation; and
 - if a level of a pull-in signal remains lower than a predetermined critical level for at least a predetermined critical period of time, controlling the objective lens so as to move away from the disc.
2. The method of claim 1, wherein the predetermined critical period of time is set to a time for which the objective lens remains a minimum distance from the disc without damaging the disc when an actuator actuating a pickup moves at an operational maximum speed.
3. The method of claim 1, wherein the controlling the objective lens comprises applying a direct current signal to the actuator for actuating a pickup having the objective lens.
4. The method of claim 3, wherein the direct current signal is applied to stop the actuator.
5. The method of claim 1, wherein the pull-in signal is one of a sum signal of signals focused onto a plurality of division light-receiving units of a photodiode and a signal generated by filtering a sum signal through a low-pass filter.
6. A method of preventing a disc from being scratched by an objective lens, the method comprising:
 - initializing a pull-in signal;
 - performing a focus pull-in;
 - checking a level of the pull-in signal;
 - if the level of the pull-in signal is lower than a predetermined critical level, checking a time for which the level of the pull-in signal remains lower than the predetermined critical level; and
 - if the time is at least a predetermined critical period of time, controlling a pickup having the objective lens to move away from the disc.

7. The method of claim 6, further comprising:
if the time is not at least the predetermined critical period of time, outputting an average value of a drive signal that was previously applied to the actuator for actuating a pickup having the objective lens.
8. The method of claim 6, wherein the initializing of the pull-in signal comprises initializing the pull-in signal to a level lower than a predetermined direct current level so as to easily detect the predetermined direct current level during the focus pull-in operation.
9. The method of claim 6, wherein, the predetermined critical period of time is set to a time for which the objective lens remains a minimum distance from the disc without damaging the disc when the actuator moves at an operational maximum speed.
10. The method of claim 6, wherein, if the time is at least predetermined critical period of time, applying a direct current signal to the actuator.
11. The method of claim 10, wherein the direct current signal is applied to stop the actuator.
12. The method of claim 6, wherein the pull-in signal is one of a sum signal of signals focused onto a plurality of division light receiving units of a photodiode and a signal generated by filtering a sum signal through a low-pass filter.
13. An apparatus preventing a disc from being scratched by an objective lens, the apparatus comprising:
a pickup having an objective lens;
an actuator actuating the pickup;
a signal detector detecting a pull-in signal from the pickup; and
a controlling unit that if a level of the pull-in signal is maintained lower than a predetermined critical level for at least a predetermined critical period of time, controls the actuator so that the objective lens moves away from the disc.
14. The apparatus of claim 13, wherein the predetermined critical period of time is set to a time for which the objective lens remains a minimum distance from the disc without damaging the disc when the actuator moves at an operational maximum speed.

15. The apparatus of claim 13, wherein the controlling unit applies a direct current signal to the actuator.

16. The apparatus of claim 13, wherein the controlling unit applies a direct current signal to the actuator so as to stop the actuator.

17. The apparatus of claim 13, wherein the pull-in signal is one of a sum signal of signals focused onto a plurality of division light receiving units of a photodiode and a signal generated by filtering a sum signal through a low-pass filter.

18. The method according to claim 1, wherein the predetermined critical level is set to a value measured at a level for which an objective lens in a pickup should not contact a disc when the pickup moves toward the disc during focus control due to a disturbance.

19. The method according to claim 6, wherein the predetermined critical level is set to a value measured at a level for which an objective lens in a pickup should not contact a disc when the pickup moves toward the disc during focus control due to a disturbance.

20. The apparatus according to claim 13, wherein the predetermined critical level is set to a value measured at a level for which the objective lens in the pickup should not contact the disc when the pickup moves toward the disc during focus control due to a disturbance.

21. A computer readable medium encoded with processing instructions implementing a method of preventing a disc from being scratched by an objective lens, the method comprising:

- performing a focus pull-in operation; and
- controlling the objective lens so as to move away from the disc if a level of a pull-in signal remains lower than a predetermined critical level for a predetermined critical period of time or more.

22. The computer readable medium of claim 21, wherein the predetermined critical period of time is set to a time for which the objective lens remains a minimum distance from the disc without damaging the disc when an actuator actuating the pickup moves at an operational maximum speed.

23. The computer readable medium of claim 21, wherein a direct current signal is applied to the actuator for actuating a pickup having the objective lens.

24. The computer readable medium of claim 21, wherein the pull-in signal is one of a sum signal of signals focused onto a plurality of division light receiving units of a photodiode and a signal generated by filtering a sum signal through a low-pass filter so as to remove a high frequency component.

25. A computer readable medium encoded with processing instructions implementing a method of preventing a disc from being scratched by an objective lens, the method comprising:

- initializing a pull-in signal;
- performing a focus pull-in;
- checking a level of the pull-in signal;
- checking a time for which the level of the pull-in signal remains lower than the predetermined critical level if the level of the pull-in signal is lower than a predetermined critical level; and
- controlling a pickup having the objective lens so as to move away from the disc if the time is at least a predetermined critical period of time.

26. An apparatus preventing a disc from being scratched by an objective lens, the apparatus comprising:

- a pickup;
- an actuator actuating the pickup;
- a signal detector detecting a pull-in signal from the pickup; and
- a controller checking levels of a detected signal and outputting a control signal; and
- a drive moving the pickup based on the control signal.

27. The apparatus of claim 26, the pickup comprising:

- a laser diode radiating a beam of light;
- a collimating lens focusing the beam of light into a parallel beam of light;
- an objective lens focusing the parallel beam onto the disc;
- a beam splitter splitting the beam of light into an incident beam of light and a reflected beam of light and changing the path of the reflected beam of light; and
- a photodiode receiving the reflected beam of light.

28. The apparatus of claim 27, the laser diode having a NA of at least 0.7, and a wavelength of 500nm or less.

29. A method of controlling a movement of a pickup, comprising:
radiating a laser beam from the pickup;
focusing the laser beam onto a surface of a reflective disc;
receiving a reflected beam of light from the disc with a plurality of light- receiving units;
generating a focus pull-in signal and a focus error signal based on the received light;
checking a level of the generated focus pull-in signal and focus error signals; and
generating a current based on the level of the signals so as to move the pickup.

30. The method of controlling a movement of a pickup of claim 28, wherein checking a level includes checking when the focus pull-in signal drops to an initial level for a predetermined period of time.

31. A method of controlling a movement of a pickup, comprising:
setting an initial value of a pickup pull-in signal;
focusing a laser beam from the pickup on a disc based on an initial value of the pulling signal;
checking a level of the pull-in signal; and
outputting a drive signal for the pickup based on the level of the pull-in signal.

32. The method of controlling a movement of a pickup as claimed in claim 31, wherein checking a level of the pull-in signal includes checking whether the pull-in signal is lower than a predetermined level for at least a predetermined critical period of time.